

PileSort Module Usage

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May 25, 2010
CMU-ISR-10-119

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Center for the Computational Analysis of Social and Organizational Systems
CASOS technical report.

This work was supported in part by the Office of Naval Research (ONR) N000140811186. Additional support was provided by the center for Computational Analysis of Social and Organizational Systems (CASOS). The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the Office of Naval Research, or the U.S. government.

Report Documentation Page			Form Approved OMB No. 0704-0188	
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1. REPORT DATE 25 MAY 2010	2. REPORT TYPE	3. DATES COVERED 00-00-2010 to 00-00-2010		
4. TITLE AND SUBTITLE PileSort Module Usage		5a. CONTRACT NUMBER		
		5b. GRANT NUMBER		
		5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)		5d. PROJECT NUMBER		
		5e. TASK NUMBER		
		5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Carnege Mellon University ,School of Computer Science,Pittsburgh,PA,15213		8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)		
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited				
13. SUPPLEMENTARY NOTES				
14. ABSTRACT The PileSort module in *ORA allows a user to load a series of entities such as concepts or people's names. These entities are displayed in a deck, which can then be organized and grouped into a pile, which will contain entities that are similar to one another. The output of the PileSort module will be a network in DyNetML format. This report overviews the PileSort module, its interface, and an example usage of the PileSort module along with analysis of results using *ORA.				
15. SUBJECT TERMS				
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 38
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified	19a. NAME OF RESPONSIBLE PERSON	

Keywords: pile sort, card sort, concept organization, concept classification, PileSort, *ORA

Abstract

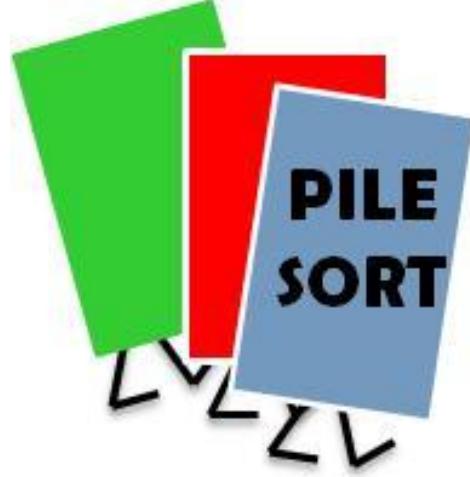
The PileSort module in *ORA allows a user to load a series of entities such as concepts or people's names. These entities are displayed in a deck, which can then be organized and grouped into a pile, which will contain entities that are similar to one another. The output of the PileSort module will be a network in DyNetML format. This report overviews the PileSort module, its interface, and an example usage of the PileSort module along with analysis of results using *ORA.

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1 Overview

The PileSort module allows a user to load a series of entities such as concepts or people's names. These entities are displayed in a deck, which can then be organized and grouped into a pile, which will contain entities that are similar to one another. The output of the PileSort module will be a network in DyNetML[1] format. PileSort is available in *ORA[2] and SORASCS[3]. When run from within *ORA, the resulting network will automatically be populated into *ORA.



2 Usage

There are two types of people who would be interested in the PileSort module: a user and an administrator. There is a user that would use the pile sort module as a means to categorize concepts into categories. Concepts can be extracted from the concept list output in AutoMap[4]. There is an administrator who would prepare the list of concepts to be categorized. It is possible to have an administrator and a user be one and the same person. This would be the case that a person is interested in using the PileSort module as a means of directly organizing concepts. The use of multiple people acting as users categorizing the concepts into piles allows for an aggregation of responses.

Step 1: Administrator prepares an input file

The administrator will use a text editor or a spreadsheet program that can output a comma separated value file to create an input file for the pile sort module to use. Figure 1 shows an example pile sort module input file. The input file contains the concepts that are to be classified in the first column. Additional metadata information can be entered into the second column. The second column is optional and the input file could be a simple list of concepts, one per line. As the text file is considered to be in comma separated value form, concepts may not contain an embedded comma.

Duplicate entries are permitted-- either by having duplicate entries within the input file or by creating another card with the same concept. Some users may wish to place cards into multiple piles. To accomplish this, the user would create an additional card with the same name to add to the other pile.

The screenshot shows a Notepad++ window with the title bar "C:\Documents and Settings\dlc85\Desktop\cards.csv - Notepad++". The menu bar includes File, Edit, Search, View, Encoding, Language, Settings, Macro, Run, TextFX, Plugins, Window, and ?. The toolbar has various icons for file operations. The main pane displays the contents of the 'cards.csv' file:

```
1 Dan,Player
2 Brian,Player
3 Cemlyn,Player
4 Geniveve,Player
5 Mike,Player
6 Al,Character
7 Arthis,Character
8 Toland,Character
9 Zikri,Character
10 Sashmore,Character
11 Jacen,NPC
12 Jaina,NPC
13 Lando,NPC
14 Julie,DM
```

At the bottom, status bars show "Normal text file", "174 chars 200 bytes 14 lines", "Ln : 1 Col : 1 Sel : 0 (0 bytes) in 0 ranges", "Dos\Windows ANSI", and "INS".

Figure 1. Sample input file in CSV form

Step 2: Each user will load the input file and sort the cards into piles

Cards are created for each concept listed in the input file. An initial screen shot after cards are loaded is found in Figure 2. The meta information in the file related to the is not shown in the pile sort module interface. The meta information will be added to the output DyNetML file.

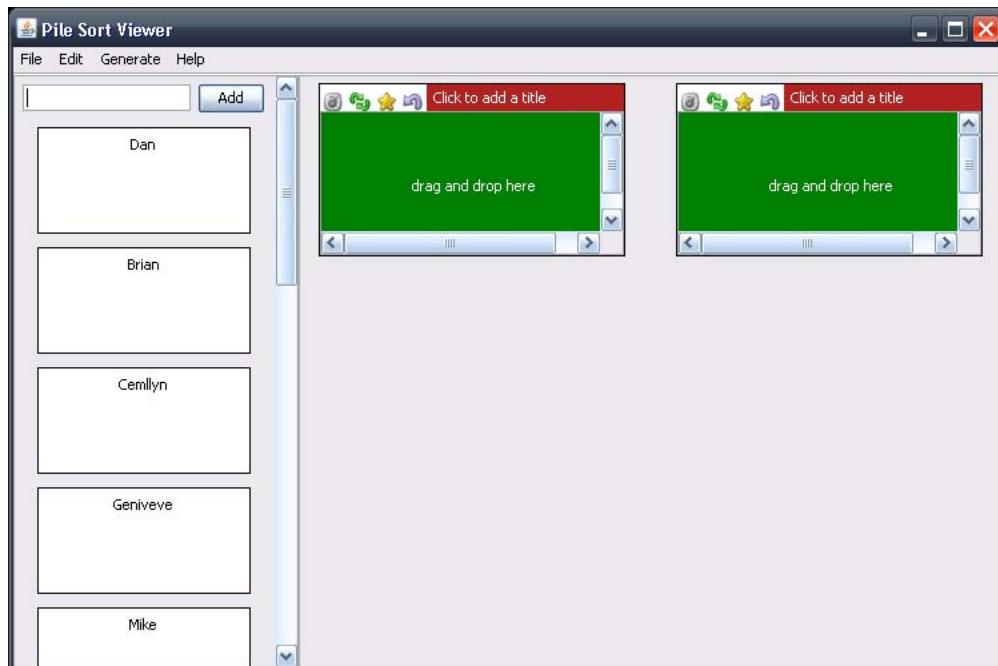


Figure 2. Initial Pile Sort Module Interface with Cards Loaded

The cards are loaded in the card deck and all piles start empty. If there are more cards than can be viewed on the card deck, a scrollbar is added to allow the user to scroll through the cards on the side deck. An empty pile has a banner "drag and drop here" to signify where the user should drop cards in order to add them to a pile. In addition, the piles start with an empty banner "Click to add title" which is replaced by an actual title when/if the user adds a title for the pile.

The user moves cards from the card deck into a pile using the mouse. To move a card, the user will click and hold the mouse button on the card in the card deck, and unclick the mouse button while hovering over the pile to which the user wishes to place the card. The PileSort module begins with an initial two piles. The user may add any number of additional piles. An empty pile, that contains no cards, is not represented in the output. If there are more decks than can be viewed on the canvas, a scrollbar is added to allow the user to scroll through the piles on the canvas.

If the user wishes to put a card into two separate piles, the user will have to create a card with the same concept name. The user would enter the name of the card in the text box at the top of the side deck and click on the add card button. A new card will be added to the bottom of the list of cards. The user can then move the additional card to a second pile.

The user does not have to place all cards into piles, though the administrator may request that a user place all cards. Any card not in a pile will be an isolate in the resulting network. In Figure 3, an additional pile has been added, all but one card has been moved into piles, and each pile has been given a title and an exemplar card is identified, with an asterisk.

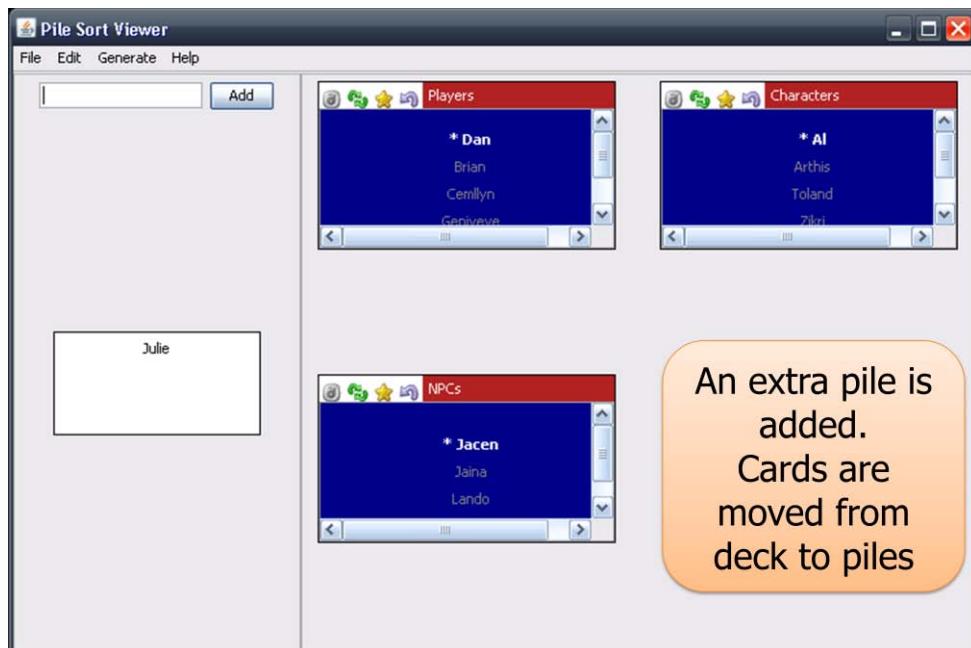


Figure 3. Cards Added to Piles

Piles are saved in a DyNetML format, and loaded into *ORA. Networks are formed from piles. Metainformation about the piles, including the metainformation provided in the input file, the title of the pile, and the exemplar (the pile's representative) are saved in the DyNetML file when outputting is requested. How networks are formed is based upon the cards that were placed into each pile. A visualization of the network from concepts being sorted into piles is shown in Figure 4. In addition, isolates are cards not assigned to a pile, such as the card Julie shown as a node disconnected from all other nodes. If there were more than one isolated node, they would each be shown similarly disconnected from all other nodes.

Figure 4. Piles in *ORA Visualizer

The *ORA system is an analysis and visualization system. The network developed from the pile sorting can be manipulated by *ORA like any other network. For example, multiple networks may be joined using the network union operation in *ORA. This will permit analysis from the result of many users classifying concepts.

3 Interface

The interface of the PileSort module is broken up into two main sections: side deck and canvas. The side deck displays cards that have not been organized into piles, such as initially when the input file is read. The canvas contains the piles. Cards are found either in the side deck or in piles. The general areas are identified in Figure 5.

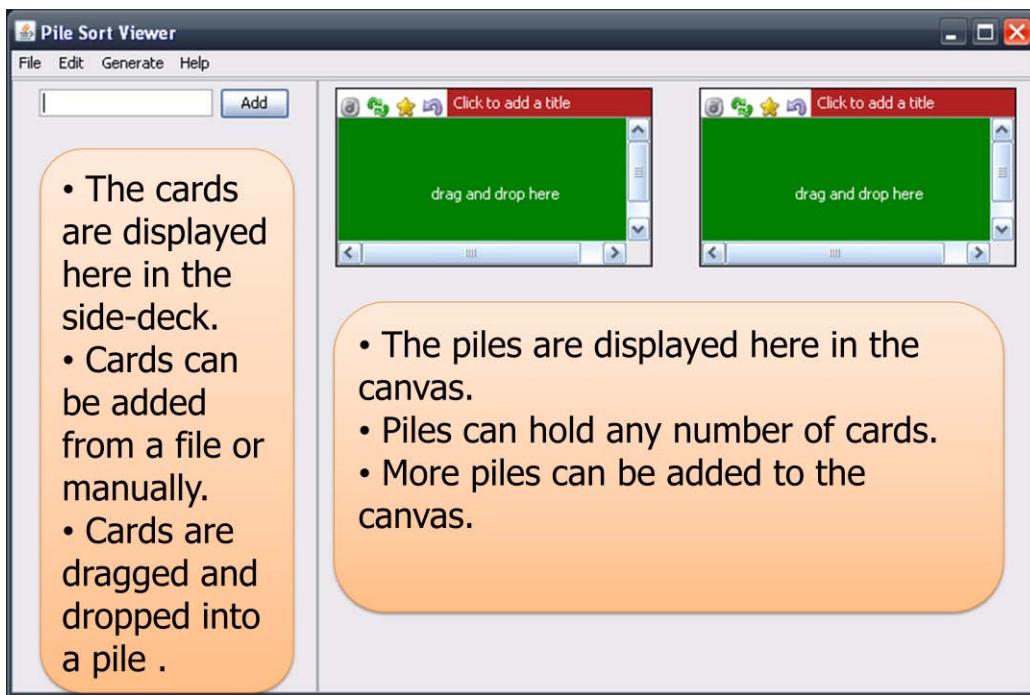


Figure 5. The PileSort Interface

The cards and piles are manipulated through a series of mouse movements. The primary activity will be to drag and drop cards from the card deck into a pile.

3.1 Main Window Actions

These actions are those found on the side deck. They are actions that have global implications. They are also available from the menu bar at the top of the PileSort module window.



Load a file

This option will load the concepts from a text file in comma separated value (CSV) format and generate cards for each concept in the file. If there are more cards than can be viewed at once on the card deck, a scroll bar is added to the pile deck to allow the user to scroll the card deck to be able to access all cards. Cards are loaded from the input file and are added to the card deck in random order.



Add an empty pile

This option will create an additional empty pile on the canvas. If there are more piles that can fit on the canvas, a scroll bar is created so that a user may scroll the canvas to be able to access all the piles. The new pile is placed at the end of the other piles. When the program starts, two empty piles are created by default.



Create a network DyNetML file

This option will create a network DyNetML file from the organization of the cards in the piles. All cards in a pile are fully connected to each other. Cards that remain on the pile deck are isolates in the network. This option will create the DyNetML and automatically populate the network into *ORA.



Show help topics

This option will provide access to the CASOS help system.

(no icon)

Add Card

This option will take the concept that has been filled into the text field next to the add card button and create a card with that name at the end of the card deck.

3.2 Pile Components



Transfer all cards to another pile

This option allows the user to select the icon, click and hold it and then drag it to another pile and release. All cards in the first pile, in which the icon is clicked, will be transferred to the second pile, in which the mouse button is released.



Cycle through the cards in the pile

This option will rotate the cards that are on the pile such that the card currently beneath the card currently highlighted will become highlighted and the previously highlighted card will no longer be highlighted. The highlighted card is the one that can be marked as a pile's representative, and is the only one that can be moved from one pile to another. Otherwise the order of cards



Return cards to the card deck

This option will remove all the cards from a pile and return them to the side card deck.



Mark a card as a pile's representative

This option will mark the currently highlighted card as the pile's representative card. The representative is designated by an asterisk by the name of the card.

(no icon)

Move card to another pile

This option allows the user to click and hold on the highlighted card, move the mouse to a new pile and release, thereby moving the highlighted card from the original pile, in which the mouse was clicked, to a new pile, in which the mouse was released. If the card to be moved is not highlighted, it is necessary to cycle through the cards in the pile until the card to be moved is highlighted.

(no icon)

Click to add a title

This option allows the entire pile to be given a name. Clicking on the title bar, initially identified as "Click to add title", will launch a prompt to which the user may enter in the name of the pile. The area originally identified as "Click to add title" will now display the new title. The user may continue to click in that area and enter different title each time, replacing the old title with a new title.

(no icon)

Drag and drop here

This option will allow a user to move a card from the card deck to a pile. The user will click and hold on top of the card he/she is interested in moving into a pile. Continue to hold the mouse and then release in the "Drag and drop here" area of a pile to move the card into that pile. The card concept will be shown as being added to the pile. Only empty piles will contain the "Drag and drop here" banner.

4 Example Usage of PileSort

The PileSort module can be used to understand how people group items together. For example, users can be asked to place colors into piles to understand how a particular subgroup of people would partition the color spectrum. An input can consist of the colors of a standard crayon box. The list of colors used as input is shown in Figure 6.

orange	brick red	blue green	orchid	blue violet	midnight	goldenrod	salmon
red orange	burnt sienna	yellow orange	red orange	lemon yellow	yellow green	forest green	raw sienna
sea green	mahogany	magenta	silver	raw umber	cadet blue	chestnut	blue gray
violet	cornflower	maroon	sky blue	periwinkle	white	violet blue	navy blue
blue green	carnation pink	green yellow	olive green	spring green	turquoise blue	yellow orange	burnt orange
brown	bittersweet	green blue	melon	aquamarine	thistle	mulberry	lavender
black	apricot	peach	maize	pine green	tan	copper	blue
red	yellow	gold	gray	red violet	violet red	plum	sepia

Figure 6. Standard Crayon Colors

Language structuring our way of thinking is called linguistic relativity, proposed by Whorf. His postulate was that some languages are better at expressing certain concepts over other languages [5]. The linguists, Berlin and Kay, in an attempt to disprove linguistic relativity, were able to construct a much more scientific argument [6]. They identified the appearance of color in languages as a strong indicator that thought structures languages. Color is a universal thing, but the way in which color is described varies differently by language. While Americans are familiar with the box of 64 colors in a crayon box, they are much more comfortable with the eight primary colors to which they then base the rest of our colors. For example, they have light blue and dark blue. The colors are different, but they use the same base eight colors to describe many of the rest of the colors. Even colors with their own names such as teal when asked, people would call green. There is nothing innate about the way in which a color spectrum has to be partitioned. Different languages are able to draw different partitioning. We use this as the basis for our example, in which we are interested in how a subgroup would organize colors.

Participants would be given the list of colors in a file, colors.csv. This file would be loaded by each individual into the PileSort module, launched from within *ORA. The individuals would be asked to sort the colors into piles. They can name the pile in whatever manner they saw fit to help them classify the colors. When they exit the PileSort module, the network will be available in *ORA. They are asked to save the network as a DyNetML file, and sent to the administrator.

Our example uses five individuals: Dan, Dave, Bradley, Jeff, and Frank. Each was given the colors.csv file (available in the appendix). Their output networks were collected (an example of one of the networks is available in the appendix) and loaded into *ORA. *ORA was also used to generate a union network as a combination of all of the input networks. Figure 7 shows the main *ORA window with the pile networks loaded and the union calculated. Statistics on the union of the pile networks is available on the right hand side, including number of concepts, number of links, and density of network.

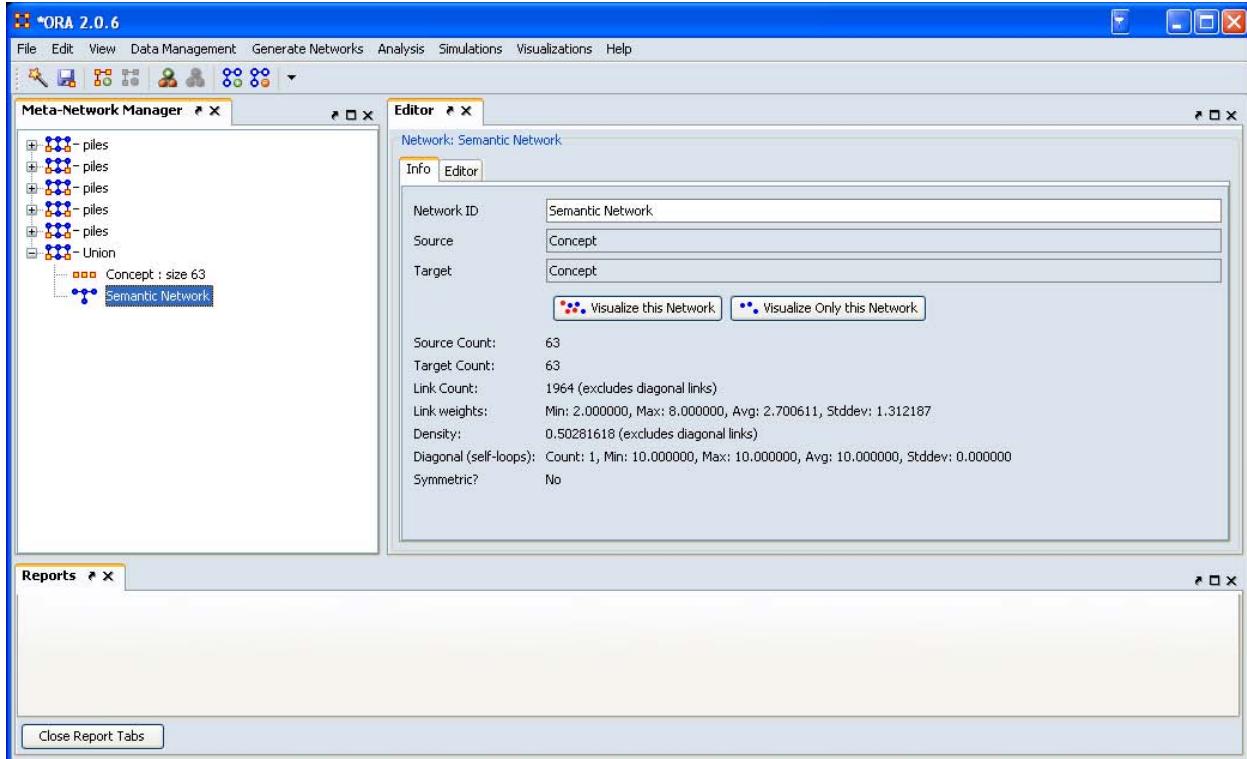


Figure 7. *ORA Main Window with pile networks loaded and union calculated

The number of links made is based on the links created in the individual networks. The number of links is based on the number of piles and the number of concepts in each pile. The number of links for each individual network is shown in Figure 8.

Network	Number of Links
Frank	246
Jeff	924
Dan	602
Dave	404
Bradley	476

Figure 8. Number of Links per Individual Network

The union of the networks will aggregate the individual responses. A visualization of the union of the networks is shown in Figure 9.

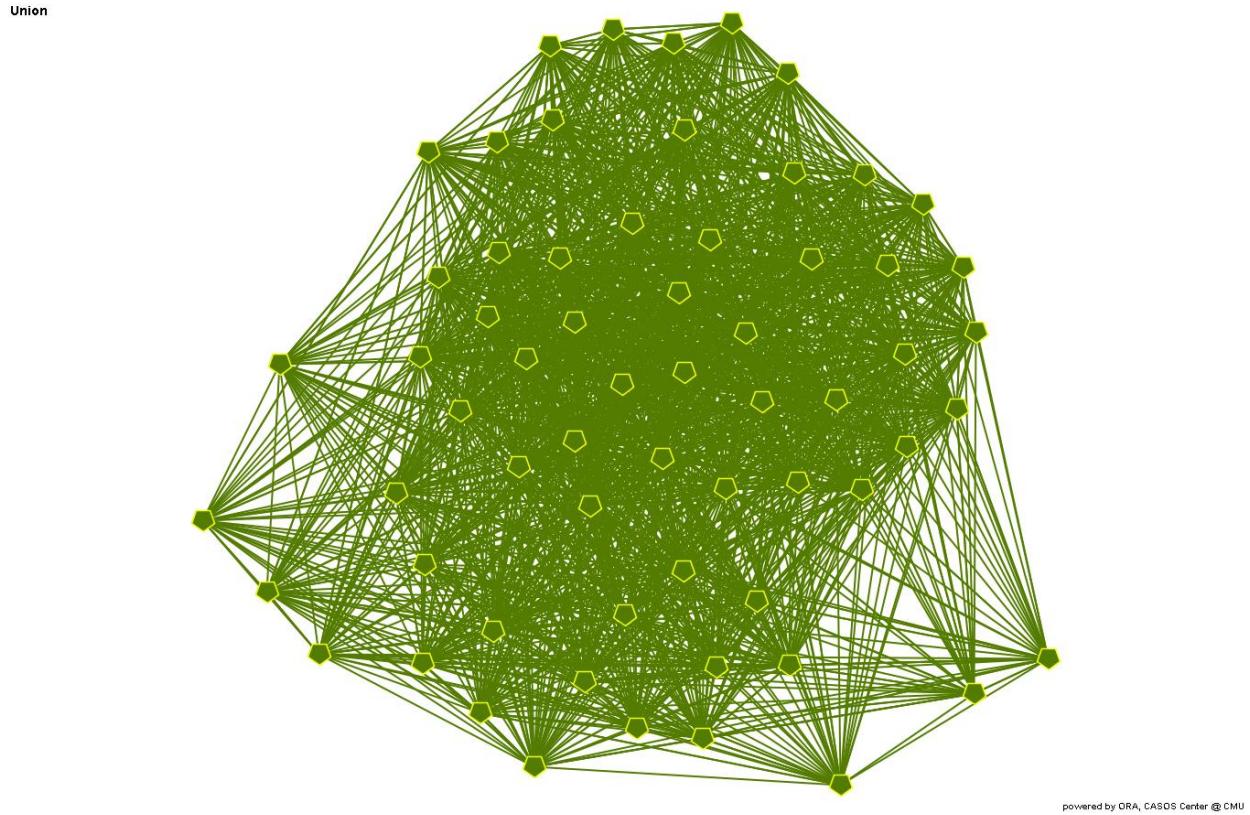


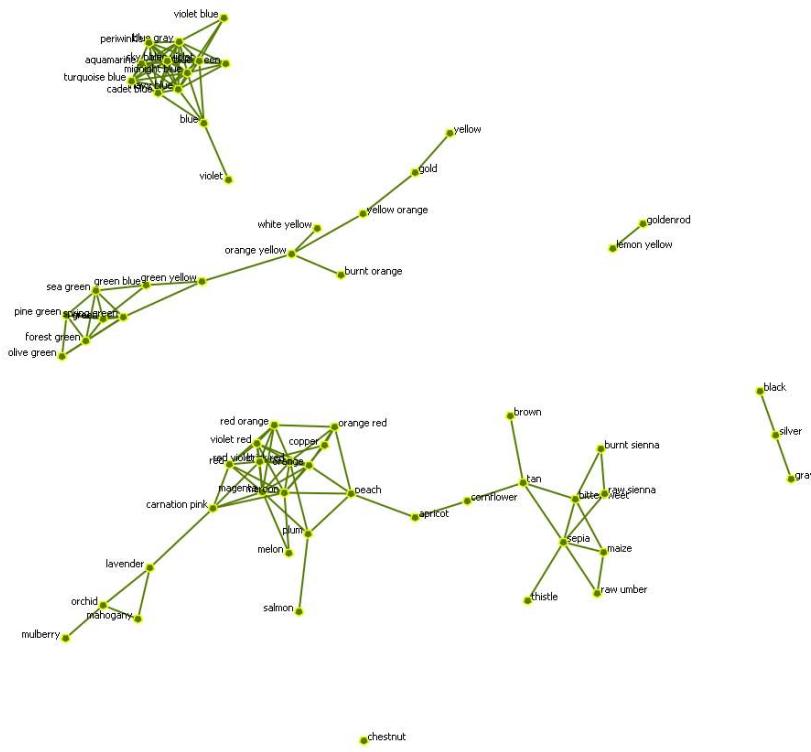
Figure 9. Union of all network piles

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Each concept is represented by an individual node in the union network. No concept was left out of all piles in for every individual, therefore there are no isolates in this network.

The links represent two concepts being placed in the same pile. A frequency value is available on each link to determine how many times two concepts were placed in the same pile. In the *ORA visualize, it is possible to filter the links to include only those links that occurred at least five times. Since there were five individuals, this result will show only those colors that were placed into the same pile by all individuals. The visualization of the union of piles, with link frequency of 5 is shown in Figure 10.

Union



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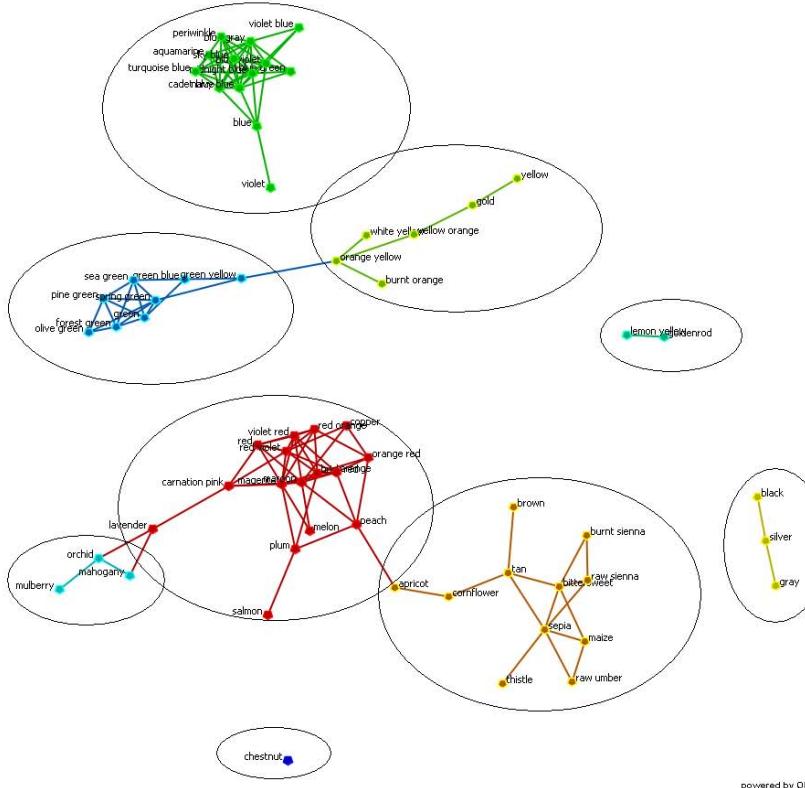
Figure 10. Concepts placed into the same piles

Looking at those concepts placed into the same piles identified several interesting (yet non-scientific) results:

The color chestnut was not put into a pile with the same colors. Four of the five individuals placed the color with other similar colors, not all five people could agree.

The colors lemon yellow and golden rod were placed into the same pile by all five individuals. The colors black and silver were always placed in the same pile, the colors silver and gray were placed in the same pile, but black and grey were not always in the same pile. Remember that a user is free to duplicate the concept and put it into multiple piles.

Using Newman grouping, nine groups are identified. The results are shown in Figure 11 using the same visualization as concepts placed into the same piles. The same grouping result was obtained with and without filtering the results, but the grouping is more obvious with a visualization of the filtered results.

Union**Figure 11. Similar concepts grouped**

The pile networks can be analyzed using all of the analysis capabilities of *ORA. This report only shows the basic analysis that can be done using the *ORA visualizer.

5 References

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- [3] Garlan D.K., Carley K.M., Schmerl B., Bigrigg M.W. and Celiku O. 2009. Using Service-Oriented Architectures for Socio-Cultural Analysis in Proceedings of the 21st International Conference on Software Engineering and Knowledge Engineering (SEKE2009), 2009 July 1-3; Boston, MA.
- [4] Carley, K.M., Columbus, D., DeReno, M., Bigrigg, M.W., Diesner, J., and Kunkel, F. (2009). AutoMap User's Guide 2009. Carnegie Mellon University, School of Computer Science, Institute for Software Research, Technical Report CMU-ISR-09-114.
- [5] Whorf, B. "Language, Thought, and Action" in Twenty Questions: An Introduction to Philosophy. Bowie, Lee, Michaels, and Solomon (eds.), HBT, 1908.
- [6] Berlin, B. and Kay, P. Basic Color Terms: Their Universality and Evolution, University of California Press, 1991.

6 Appendix

6.1 Sample input file

```
color.csv
black
blue
brown
green
orange
red
violet
yellow
apricot
bittersweet
blue green
blue violet
brick red
burnt sienna
carnation pink
cornflower
peach
gold
```

gray
green blue
green yellow
lemon yellow
magenta
mahogany
maize
maroon
melon
olive green
orange red
orange yellow
orchid
periwinkle
pine green
midnight blue
red orange
red violet
salmon
sea green
silver
spring green
tan
thistle
turquoise blue
violet blue
violet red
white yellow
green
yellow orange
aquamarine
blue gray
burnt orange
cadet blue
copper
forest green
goldenrod
chestnut
lavender
mulberry
navy blue
plum
raw sienna
raw umber
sepia
sky blue

6.2 Sample output file

network.xml

```
<?xml version="1.0" standalone="yes" ?>
- <DynamicNetwork>
- <MetaNetwork id="piles">
- <propertyIdentities>
<propertyIdentity id="Number of piles" type="text" singleValued="false" />
<propertyIdentity id="Number of cards" type="text" singleValued="false" />
</propertyIdentities>
- <sources>
- <source id="piles">
<property id="Number of piles" value="8" />
<property id="Number of cards" value="64" />
</source>
</sources>
- <nodes>
- <nodeclass type="Knowledge" id="Concept">
- <propertyIdentities>
<propertyIdentity id="containing_pile" type="text" singleValued="false" />
<propertyIdentity id="relative_frequency" type="text" singleValued="false" />
<propertyIdentity id="frequency" type="number" singleValued="false" />
<propertyIdentity id="seconds_on_top" type="text" singleValued="false" />
<propertyIdentity id="meta_information" type="text" singleValued="false" />
</propertyIdentities>
- <node id="apricot">
<property id="containing_pile" value="oranges" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.10" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="aquamarine">
<property id="containing_pile" value="blues" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.09" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="bittersweet">
<property id="containing_pile" value="oranges" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.73" />
<property id="relative_frequency" value="1.0" />
</node>
```

```
- <node id="black">
<property id="containing_pile" value="grays blacks and white" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="0.97" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="blue">
<property id="containing_pile" value="blues" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.15" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="blue gray">
<property id="containing_pile" value="blues" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.07" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="blue green">
<property id="containing_pile" value="blues" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.03" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="blue violet">
<property id="containing_pile" value="blues" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="0.98" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="brick red">
<property id="containing_pile" value="reds" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.85" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="brown">
<property id="containing_pile" value="Browns" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
```

```
<property id="seconds_on_top" value="1.37" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="burnt orange">
<property id="containing_pile" value="oranges" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.09" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="burnt sienna">
<property id="containing_pile" value="oranges" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="3.26" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="cadet blue">
<property id="containing_pile" value="blues" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="0.87" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="carnation pink">
<property id="containing_pile" value="reds" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.22" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="chestnut">
<property id="containing_pile" value="reds" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.49" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="copper">
<property id="containing_pile" value="Browns" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.13" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="cornflower">
```

```
<property id="containing_pile" value="blues" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.03" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="forest green">
<property id="containing_pile" value="greens" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.34" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="gold">
<property id="containing_pile" value="yellows" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="2.24" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="goldenrod">
<property id="containing_pile" value="yellows" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="4.03" />
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</node>
- <node id="gray">
<property id="containing_pile" value="grays blacks and white" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.04" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="green">
<property id="containing_pile" value="greens" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.05" />
<property id="seconds_on_top" value="1.53" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="green blue">
<property id="containing_pile" value="greens" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
```

```
<property id="seconds_on_top" value="1.47" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="green yellow">
<property id="containing_pile" value="greens" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.68" />
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</node>
- <node id="lavender">
<property id="containing_pile" value="reds" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="2.46" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="lemon yellow">
<property id="containing_pile" value="yellows" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="2.44" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="magenta">
<property id="containing_pile" value="reds" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.08" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="mahogany">
<property id="containing_pile" value="Browns" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.13" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="maize">
<property id="containing_pile" value="Browns" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.22" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="maroon">
```

```
<property id="containing_pile" value="reds" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.13" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="melon">
<property id="containing_pile" value="reds" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.20" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="midnight blue">
<property id="containing_pile" value="blues" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.02" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="mulberry">
<property id="containing_pile" value="purples" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.11" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="navy blue">
<property id="containing_pile" value="blues" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="0.72" />
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- <node id="olive green">
<property id="containing_pile" value="greens" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.53" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="orange">
<property id="containing_pile" value="oranges" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.33" />
```

```
<property id="relative_frequency" value="1.0" />
</node>
- <node id="orange red">
<property id="containing_pile" value="oranges" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="0.87" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="orange yellow">
<property id="containing_pile" value="oranges" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.55" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="orchid">
<property id="containing_pile" value="purples" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.08" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="peach">
<property id="containing_pile" value="oranges" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.70" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="periwinkle">
<property id="containing_pile" value="blues" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.17" />
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- <node id="pine green">
<property id="containing_pile" value="greens" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.66" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="plum">
<property id="containing_pile" value="purples" />
```

```
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.15" />
<property id="relative_frequency" value="1.0" />
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- <node id="raw sienna">
<property id="containing_pile" value="Browns" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="3.22" />
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</node>
- <node id="raw umber">
<property id="containing_pile" value="Browns" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
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</node>
- <node id="red">
<property id="containing_pile" value="reds" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="0.82" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="red orange">
<property id="containing_pile" value="reds" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.32" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="red violet">
<property id="containing_pile" value="reds" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="0.87" />
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</node>
- <node id="salmon">
<property id="containing_pile" value="oranges" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.05" />
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```
</node>
- <node id="sea green">
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<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.59" />
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</node>
- <node id="sepia">
<property id="containing_pile" value="Browns" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.27" />
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</node>
- <node id="silver">
<property id="containing_pile" value="grays blacks and white" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.07" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="sky blue">
<property id="containing_pile" value="blues" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="0.90" />
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</node>
- <node id="spring green">
<property id="containing_pile" value="greens" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.36" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="tan">
<property id="containing_pile" value="Browns" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.31" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="thistle">
<property id="containing_pile" value="purples" />
<property id="meta_information" value="" />
```

```
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.38" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="turquoise blue">
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<property id="meta_information" value="" />
<property id="frequency" value="1" />
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</node>
- <node id="violet">
<property id="containing_pile" value="purples" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="0.82" />
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</node>
- <node id="violet blue">
<property id="containing_pile" value="purples" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="0.98" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="violet red">
<property id="containing_pile" value="reds" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.39" />
<property id="relative_frequency" value="1.0" />
</node>
- <node id="white yellow">
<property id="containing_pile" value="grays blacks and white" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.14" />
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- <node id="yellow">
<property id="containing_pile" value="yellows" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
<property id="seconds_on_top" value="1.80" />
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</node>
```

```

- <node id="yellow orange">
<property id="containing_pile" value="yellows" />
<property id="meta_information" value="" />
<property id="frequency" value="1" />
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```

```
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```

```
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```
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<link source="orange yellow" target="orange" value="1.0" />
<link source="red orange" target="maroon" value="1.0" />
<link source="raw umber" target="copper" value="1.0" />
```

```
<link source="raw umber" target="maize" value="1.0" />
<link source="red orange" target="chestnut" value="1.0" />
<link source="magenta" target="carnation pink" value="1.0" />
<link source="green blue" target="olive green" value="1.0" />
<link source="forest green" target="olive green" value="1.0" />
<link source="aquamarine" target="blue green" value="1.0" />
<link source="navy blue" target="cadet blue" value="1.0" />
<link source="mahogany" target="copper" value="1.0" />
<link source="lavender" target="carnation pink" value="1.0" />
<link source="lavender" target="brick red" value="1.0" />
<link source="red" target="magenta" value="1.0" />
<link source="navy blue" target="sky blue" value="1.0" />
<link source="brown" target="maize" value="1.0" />
<link source="orange red" target="orange" value="1.0" />
<link source="sepia" target="copper" value="1.0" />
<link source="blue gray" target="aquamarine" value="1.0" />
<link source="midnight blue" target="periwinkle" value="1.0" />
<link source="magenta" target="lavender" value="1.0" />
<link source="silver" target="black" value="1.0" />
<link source="blue green" target="sky blue" value="1.0" />
<link source="periwinkle" target="cornflower" value="1.0" />
<link source="mulberry" target="orchid" value="1.0" />
<link source="tan" target="maize" value="1.0" />
<link source="pine green" target="spring green" value="1.0" />
<link source="melon" target="violet red" value="1.0" />
<link source="burnt sienna" target="orange red" value="1.0" />
<link source="maroon" target="melon" value="1.0" />
<link source="thistle" target="plum" value="1.0" />
<link source="blue violet" target="aquamarine" value="1.0" />
<link source="green" target="green blue" value="1.0" />
<link source="cadet blue" target="blue" value="1.0" />
<link source="mahogany" target="sepia" value="1.0" />
<link source="peach" target="apricot" value="1.0" />
<link source="red" target="red orange" value="1.0" />
<link source="yellow orange" target="yellow" value="1.0" />
<link source="orange red" target="salmon" value="1.0" />
<link source="green yellow" target="pine green" value="1.0" />
<link source="bittersweet" target="orange red" value="1.0" />
<link source="forest green" target="pine green" value="1.0" />
<link source="brown" target="raw sienna" value="1.0" />
<link source="red violet" target="chestnut" value="1.0" />
<link source="orange" target="apricot" value="1.0" />
<link source="turquoise blue" target="periwinkle" value="1.0" />
<link source="blue violet" target="blue" value="1.0" />
<link source="red" target="red violet" value="1.0" />
<link source="blue violet" target="cadet blue" value="1.0" />
```

```

<link source="orange red" target="apricot" value="1.0" />
<link source="mahogany" target="raw sienna" value="1.0" />
<link source="sea green" target="pine green" value="1.0" />
<link source="turquoise blue" target="blue violet" value="1.0" />
<link source="blue violet" target="cornflower" value="1.0" />
<link source="burnt sienna" target="peach" value="1.0" />
<link source="lavender" target="melon" value="1.0" />
<link source="midnight blue" target="aquamarine" value="1.0" />
<link source="turquoise blue" target="blue" value="1.0" />
<link source="red violet" target="maroon" value="1.0" />
<link source="red orange" target="lavender" value="1.0" />
<link source="tan" target="brown" value="1.0" />
<link source="navy blue" target="periwinkle" value="1.0" />
<link source="mahogany" target="brown" value="1.0" />
<link source="blue gray" target="blue" value="1.0" />
<link source="periwinkle" target="cadet blue" value="1.0" />
<link source="raw sienna" target="copper" value="1.0" />
<link source="red violet" target="magenta" value="1.0" />
<link source="maroon" target="violet red" value="1.0" />
<link source="burnt orange" target="salmon" value="1.0" />
<link source="lavender" target="violet red" value="1.0" />
<link source="violet blue" target="thistle" value="1.0" />
<link source="peach" target="burnt orange" value="1.0" />
<link source="green blue" target="spring green" value="1.0" />
<link source="red" target="violet red" value="1.0" />
<link source="red" target="brick red" value="1.0" />
<link source="sea green" target="olive green" value="1.0" />
<link source="chestnut" target="violet red" value="1.0" />
<link source="bittersweet" target="apricot" value="1.0" />
</network>
</networks>
</MetaNetwork>
</DynamicNetwork>

```

6.3 Sample union file

union.xml

